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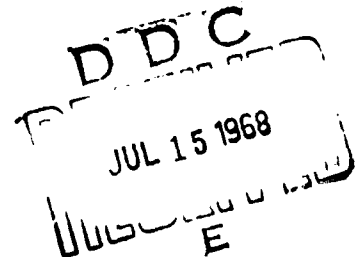
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DANGER OF INFECTION IN THE TUBERCULOSIS LABORATORY

(Following is the translation of an article by Joachim Albrecht, Department of Medicine, Trier, published in the German language periodical Tuberkulosearzt, (The Tuberculosis Doctor), vol. 15, 1961, pages 563-566. Translation performed by Constance L. Lust.)

Differing reports appear in the literature about the extent and the frequency with which microbiological-laboratory personnel are exposed to an occupational infection. Brinkmann (3) believes that medical technicians are only minimally endangered if they work carefully. They are only endangered under special circumstances, such as a liquid spray containing bacteria. According to Jensen (5) an accidental infection which could be called an occupational illness can only result from spilling liquids or injection. On the other hand Reitzan and Wedum (11), Sulkin and Pike (14), Williams and Lidwell (18), and Long (7) feel that lab infections occur relatively frequently and point out that even when careful techniques are used the risk of infection cannot be avoided.

An investigation to clarify these opposite points of view must seek to answer the following questions.

1) What possibilities exist in a laboratory, where safety-measures are followed, that a pathogen could escape uncontrolled and endanger the personnel?

2) Is the frequency of TB infection of lab personnel higher than in other similar occupational groups?

1) As has been demonstrated in many reports (2,6,11,15,16,17) almost every lab manipulation can lead to the production of aerosols, which can trap germs. The danger from this source is all the greater to personnel because the production of an aerosol occurs unnoticed and remains undetected. Since the source is very often quite close to the face of the worker, an infection through inhalation may occur. The germs can also be suspended in air without a water "jacket". The particles occur in many different sizes. The moisture of the larger drops evaporates rapidly in the dry lab air, and in this dry germs result. If drops are spilled on lab benches the dried germs may then mix with air particles. They may actually be carried in the air attached to dust particles.

Many laboratory procedures lead to aerosol production, and thus suspension of infective materials (1,2,6,9,11,16): blowing out of pipettes, scraping of loops, working with mortar and pestle, infected animals, freeze-drying apparatuses, and lyophilized cultures. Aerosols are also formed when cultures are shaken, mixed, stirred, or centrifuged. These procedures

are similar to waves, which produce aerosols containing salt, hitting the ocean shores. If the culture is in a closed container, then the aerosol escapes only upon opening of the container. This, as well as the fact that the tops (or caps) of the container are infected, is often not considered by lab personnel (15,17). When a culture flask breaks - eg. by centrifuging - a polydisperse aerosol results. This contaminates not only the immediate spot itself, but also a great part of the surrounding area and air in the room.

The following reasons substantiate that lab-infections occur by means of aerosols more frequently than is commonly assumed: a) the origin and manner of aerosol formation are generally unknown; b) for this reason personnel think that some techniques are harmless, when they are really a danger to their health; c) aerosols are produced unseen and unnoticed; d) because these particles remain suspended in air infection may occur long after the production of the aerosol; e) the usual safety precautions are insufficient.

2) The studies of Sulkin and Pike (14) in the USA give an indication of the danger of lab personnel. They tabulated 1342 lab-infections from the literature and through a questionnaire. The trained technical personnel of diagnostic laboratories were most concerned. 153 cases (11.4%) were of TB nature, 24 of which were definite (mostly skin tuberculosis), 101 probable cases, and 28 possible cases, were obtained in the laboratory. Riggins (12) reported that in the USA the TB morbidity of student-nurses, lab technicians, and medical students was greater than for other hospital personnel. These findings show that another factor is involved for lab personnel, above mere contact with patients. Reid (10) reported that in England from 1949-1953 pathologists and technical personnel had a higher rate of TB infection which lead to incapacitation than similar occupations. The author concludes that lab-work in pathology and bacteriology is associated with the danger of an illness of tuberculosis of the lung.

The finding that personnel working in labs where TB-infected materials or TB cultures are under study become infected more frequently than people in other professions, appears to be in contradiction with other reports that few accidental TB infections occur in the TB laboratory. From several reports (1,7,9,11) it is now clear that an unseen danger exists in the form of infectious aerosols. Also the number of investigations that can produce infective aerosols is increasing. Everybody realized the danger of a spray of tuberculosis. But, very often people are not aware that infectious aerosols occur daily in the lab. These do not occur only by accident, as breaking of a culture flask, but also during different common procedures which are normally thought to be harmless. In this way people get infected lungs. Schroeder (13) reported that a technician became infected with TB in a laboratory. This undoubtedly occurred via the aerosol route.

On the basis of the answers to the questions which were posed earlier the following requirements must be considered:

1) The TB-laboratory should be considered to be just as dangerous to infection as a hospital ward where TB is treated.

2) Association with cultures of Tubercle bacteria and technical manipulations of TB infected materials are just as contagious as contact with TB patients.

3) In-so-far as safety measures are possible and meaningful, the accident prevention program about infections must consider aerosols, as is already the case in England.

4) Finally, the source of a tuberculosis infection should be quickly ascertained if it occurs in lab personnel. It should be quickly determined whether the infection was contracted on the job in the laboratory, or whether it was contracted during outside activities. If a real non-occupation-associated source is not established the assumption can be made that it was contracted in the laboratory, since here a danger exists. The techniques are conscientious.

Summary: Tuberculosis hazards for the laboratory personnel of sanatoria

Many procedures commonly carried out in microbiological laboratories are liable to result in the production of infected sprays or aerosols. Although this possibility of infection by airborne particles has hitherto received little attention, the observation by English and American authors that the frequency of tuberculosis among laboratory personnel is higher than among comparable occupational groups clearly indicates that it constitutes a very real risk.

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